

**Claims**

1. A catalyst system including the combination of
  - a source of tungsten;
  - 5 - a ligand precursor containing at least N or O as a bonding atom to bond to the tungsten in the source of tungsten, the source of tungsten and the ligand precursor being selected to form an acid due to the bonding of the ligand precursor to the tungsten;and the catalyst system being characterized therein that it is substantially free of  
10 the acid formed due to the bonding of the ligand precursor to the tungsten; and that the molar ratio of the tungsten in the source of tungsten to ligand precursor is at least  $1: 3/n$  where  $n$  is the number of bonds that the ligand precursor forms with the tungsten.
- 15 2. The catalyst system of claim 1 wherein the molar ratio of the tungsten in the source of tungsten to ligand precursor is at least  $1:4/n$ .
3. The catalyst system of claim 2 wherein the molar ratio of the tungsten in the source of tungsten to ligand precursor is not higher than  $1:5/n$ .
- 20 4. The catalyst system of claim 3 wherein the molar ratio of the tungsten in the source of tungsten to ligand precursor is about  $1:4/n$ .

5. The catalyst system of any one of the preceding claims wherein the tungsten in the source of tungsten is in the 6+ oxidation state.
6. The catalyst system of any one of the preceding claims wherein the  
5 source of tungsten is selected from the group of compounds consisting of an organic salt of tungsten; an inorganic salt of tungsten; and an organometallic complex of tungsten.
7. The catalyst system of claim 6 wherein the source of tungsten is a  
10 tungsten halide.
8. The catalyst system of any one of the preceding claims wherein the ligand precursor includes only N and/or O as bonding atoms to bond to the tungsten.  
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9. The catalyst system of claim 8 wherein the ligand precursor includes only two such bonding atoms which atoms are in the form of N and/or O and which are the same or different.
- 20 10. The catalyst system of claim 8 wherein the ligand precursor includes a single such bonding atom which atom is in the form of N or O.
11. The catalyst system of claim 10 wherein the ligand precursor is a

compound of the formula  $R^1_qNH_{3-q}$ , wherein q is from 1-2 and  $R^1$  is an organic moiety,  $R^1$  being the same or different when  $q=2$ .

12. The catalyst system of claim 11 wherein at least one  $R^1$  group is an  
5 aromatic compound.

13. The catalyst system of claim 12 wherein the ligand precursor is a compound selected from the group consisting of aniline and a substituted aniline.

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14. The catalyst system of any one of the preceding claims which includes an activator.

15. The catalyst system of claim 14 wherein the activator is a compound  
15 containing a Group 3A atom.

16. A method of preparing a catalyst system comprising the steps of combining

- a source of tungsten;
- 20 - a ligand precursor containing at least N or O as a bonding atom to bond to the tungsten in the source of tungsten, the source of tungsten and the ligand precursor being selected to form an acid due to the bonding of the ligand precursor to the tungsten;

wherein the molar ratio of the tungsten in the source of tungsten to ligand precursor is at least  $1: 3/n$ , where  $n$  is the number of bonds that the ligand precursor forms with the tungsten; and the method including the step of removal or neutralisation of acid formed due to the bonding of the ligand precursor to the tungsten.

17. The method of claim 16 wherein the formed acid is neutralized by the addition of a base.
- 10 18. The method of either one of claims 16 or 17 which includes the step of adding an activator for activating the catalyst system.
19. A catalyst system prepared by the method of any one of claims 16 to 18.
- 15 20. A process for the dimerisation of a starting olefinic compound or codimerisation of different starting olefinic compounds, each starting olefinic compound being in the form of an olefin or a compound that includes an olefinic moiety, the process comprising the steps of mixing at least one starting olefinic compound with a catalyst system of any one of claims 1 to 15 to form a dimerised product of a starting olefinic compound or a codimerised product of different starting olefinic compounds.
- 20 21. The process of claim 20 wherein each starting olefinic compound is an  $\alpha$ -

olefin.

22. The process of claim 21 wherein the  $\alpha$ -olefin has five or more carbon atoms and has only one double bond between carbon atoms.

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23. The process of any one of claims 20 to 22 wherein the dimerised or codimerised product has only a single branch formed due to the dimersation.

24. The process of claim 23 wherein the single benched formed due to  
10 dimersation is a methyl branch.

25. A dimerised product or codimerised product produced by the process of any one of claims 20 to 24.

15 26. The use of a catalyst system of any one of claims 1 to 15, to dimerise or codimerise one or more olefinic compounds in the form of olefins or compounds including an olefinic moiety by mixing at least one starting olefinic compound with the catalyst system of any one of claims 1 to 15 to form a dimerised product of a starting olefinic compound or a codimerised product of different  
20 starting olefinic compounds.